



APALACHICOLA RIVER AND BAY WATERSHED EXPLORATIONS

Apalachicola National Estuarine Research Reserve



SEA GRASS SCIENTISTS FIFTH GRADE

Apalachicola National Estuarine Research Reserve
Florida Department of Environmental Protection

261 7th Street
Apalachicola, FL 32320
850-653-8063

June 2004

ACKNOWLEDGMENTS

Apalachicola River and Bay Watershed Explorations is a cooperative project between the Friends of the Reserve, Inc. and the Apalachicola National Estuarine Research Reserve. Financial support for this publication was provided by the Florida Department of Environmental Protection and a grant under the Federal Coastal Zone Management Act, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, Silver Spring, MD.

Project director: Erik Lovestrand, Education Coordinator, Apalachicola National Estuarine Research Reserve with assistance from Lisa Bailey, Reserve Education Specialist

Curriculum writing and design: Lauren Tyler, Christine Denny, and Susan Marynowski- Pandion Systems, Inc.

We appreciate the assistance of several Franklin and Gulf County, Florida teachers in planning this curriculum. Their input and feedback was an integral part of the design process.

Thank you to:

JoAnn Ardire, Polly Edmiston, Fay Henderson, Teresa Howard, Andrea Keuchel, Diane McGrath, LeeAnne Poloronis, Pam Schaffer, Gina Taranto, and Carol Weyrich

For more information or to obtain a copy of this curriculum contact:

Erik Lovestrand, Education Coordinator
Apalachicola National Estuarine Research Reserve

Erik.Lovestrand@dep.state.fl.us

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SEAGRASS SCIENTISTS

CONCEPT

Students will learn about the jobs that estuarine scientists and wildlife biologists perform by simulating a sampling method that measures the health of a seagrass community over time.

OBJECTIVES

1. Students will learn how and why scientists use quadrats (a type of research unit) to collect data.
2. Students will compare sets of data and interpret their results.
3. Students will learn about the role that wildlife biologists and estuarine scientists play in protecting the watershed.
4. Students will make recommendations for future research and management options.

METHOD

Students will simulate an ecological sampling method called quadrat sampling to determine the health of a seagrass community over time.

Grade level: 5th Grade

Subjects: Science, Language Arts, and Mathematics

Location: Classroom, outside, or cafeteria/multi-purpose room

Materials: Chalkboard, chalk or white board marker, module components

Duration: Three class periods

Sunshine State Standards: Listed on p. 8 of the activity

INTRODUCTION:

Estuarine scientists and wildlife biologists perform research to evaluate the health of ecosystems. In this activity students will simulate a sampling method called **quadrat sampling** to determine the **percent cover** of **seagrasses** in Apalachicola Bay over time.

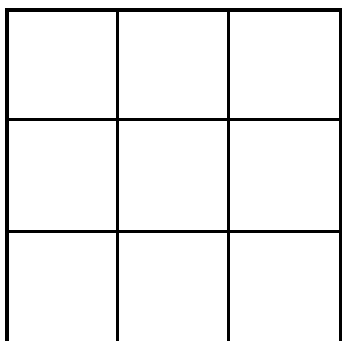
The scientists are **monitoring** the seagrass density because seagrasses provide many vital functions in the ecosystem, including anchoring sediments (soils) to prevent erosion, providing a safe and sheltered nursery for **young fish** and invertebrates, and providing vital

food sources for **grazers** such as manatees, sea turtles, and sea urchins.

Quadrats from three different time periods (1980, 1990, and 2000) will be sampled. Quadrat sampling is a way to study a large area by looking at smaller sections, or samples to determine the state of the whole system. Quadrat sampling is often used when studying ecosystems such as a seagrass community, an estuary, wetlands, rivers, or pine forests. It helps scientists understand what is going on in the ecosystem without having to study every inch of an area that could be

many miles across. When done properly, the information collected from quadrat sampling can be generalized to the whole area. When quadrat sampling is used in field research, the quadrats are placed randomly so that the data collected will represent the entire ecosystem. All of the quadrats together make up a “**research plot**”. The data from the research plot is then used to make generalizations about the whole area.

Example of a 3m by 3m square research plot. Each square is a quadrat.



PREPARATION ACTIVITIES:

These preparation activities will help students learn about the seagrass community.

1. Watch the seagrass video.
2. After watching the seagrass video, lead a class discussion on seagrasses, their value to the ecosystem, signs of good seagrass health, and potential impacts that could harm the seagrasses.
3. Ask students to fill out Data Sheet 1, which asks them to describe a healthy seagrass community and the things that could impact the health of that community.

GETTING READY:

1. Set up the three research plots from 1980, 1990, and 2000. Follow the directions in the bags for setup. If a larger space is needed, the activity can be done outside or in the cafeteria.
2. On the chalkboard draw three grids like the one to the left. These will represent the three research plots and will be used to record the students' data.
3. Provide data sheets and at least five long pieces of yarn to estimate the plant cover for each species for each group.

ACTIVITY:

Students will collect information on a simulated seagrass community by studying research quadrats that are part of a larger research plot in the classroom. Information will be collected on characteristics of seagrass bed such as the density of plant and animal species and impacts to the area. Students will compare changes in the community over time and make inferences as to the state of the community (healthy, in decline, etc.) at that time period. After the class has compiled their research and shared their results, each student will then determine the state of the seagrass community and make recommendations for the management of the community.

Students will work in groups of two or three with nine total groups. Students will be given some historical information and descriptive data about the seagrass community that they will be studying.

1. Read the activity scenario to the students:

ACTIVITY SCENARIO

Imagine you are wildlife biologists and estuarine scientists that have been monitoring the health of local seagrass beds for many years. Data has been collected for 30 years and your job is to look for changes that have occurred over time to determine: a) what has happened to the grasses, b) why any changes may have happened, and c) how these changes may affect the system as a whole.

You are using a method called "quadrat mapping" to conduct your research. Quadrat mapping is a way of studying a large area by breaking it down into smaller sections, or quadrats. For this project the research plot is a square research plot that measures 3 meters by 3 meters. This square is then broken into smaller quadrats that each measure 1 meter by 1 meter. Your team will be looking at one quadrat over a period of time. Data was collected in 1980, 1990, and 2000. Your job is to look at your quadrat data during each of these times and collect information about the seagrass community that you will record on your data sheet.

2. Explain to the students that three research plots from the seagrass community are laid out on the floor. Each plot represents the same area but from different years (1980, 1990, 2000). The map is divided into 9 1m by 1m

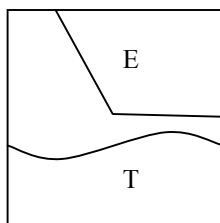
quadrats (squares). Ask them to take a look at each of the research plots as a whole. Do they see any distinguishing features (i.e. barren areas, certain types of grasses in certain areas)? Why do they think this occurred (i.e. human impacts, succession, soils)?

3. Have each team choose one quadrat from the same location of each map for all three years: 1980, 1990, and 2000. Remove your quadrats from each research plot and find a space in the classroom for your team to work.
4. Students should also take a packet with information that explains details about human impacts, weather occurrences, and other factors that have affected the health of the community. Students will use this information during the follow-up discussion.
5. The teams should first record any animal species that are found in their quadrat on Data Sheet 2. The students will also identify the species of seagrasses (it will be on the card).
6. Show students how to use the yarn to create a circle or other shape that will help them estimate the amount of coverage in terms of a fraction. See the section on *How to calculate species cover* for directions.
7. Show students how to calculate species cover by showing an example on the chalkboard. See the section on *How to calculate species cover* for directions.

How to calculate species cover:

- Determine what species are included in your research plot. See the key to determine species types.
- Look closely at each species and estimate the amount of coverage in terms of a fraction ex: shoal grass covers $\frac{1}{2}$ of the quadrat and manatee grass covers $\frac{1}{4}$ of the quadrat. Since this is subjective, students must be in agreement when collecting data. If there is discrepancy between the students they should all decide as a team what they feel the coverage is.
- To help visualize the fraction of each species use the long pieces of yarn to create a closed circle or shape. The shape will depend on the locations of the grasses in the plot.
- Transfer the shape to your data sheet. Look at the shape and estimate the fraction of the quadrat that it covers. (See figure 2)
- After the coverage of each species is determined, the barren area can be determined by subtracting all previously estimated fractions from 1. (See figure 3)

Figure 1 Sample Quadrat with species circled with yarn



T=manatee grass

E=shoal grass

Barren areas are outside of the circled areas

Figure 2 Estimated coverage areas for plant species

Species	Cover
Shoal grass (E)	$\frac{1}{2}$
Manatee grass (T)	$\frac{1}{4}$
Barren	$\frac{1}{4}$

- Calculate each species percent cover by using the following equation:

Using shoal grass as an example
 Coverage of shoal grass = $\frac{1}{2} \times 100 = 50\%$

Figure 3 Calculated Percent Covers

Species	% Cover
Shoal grass (E)	50%
Manatee grass (T)	25%
Barren	25%
Total	100%

(To check your work, all percentages should add up to 100%)

8. Students will complete this exercise for each quadrat (1980, 1990, and 2000). Each student group should also record all data for each species (in percentages) on the chalkboard within the corresponding square. By the end of the exercise, the three research plots that were drawn on the chalkboard should be full with information from 9 teams.
9. After all of the data has been collected and recorded both on data sheets as well as on the chalkboard students will calculate the total percent of coverage for each species over the entire research plot which will be the total of the coverage for all nine quadrats divided by nine. For each quadrat, Q# = quadrat number (1-9). For example the percent cover of shoal grass from each quadrat will be added together and divided by nine.

$$\text{Total Percent cover for shoal grass} = \frac{Q1+Q2+Q3+Q4+Q5+Q6+Q7+Q8+Q9}{9}$$

Calculate the overall coverage for each year (1980, 1990, 2000), for each plant species, and for the barren area.

10. Ask all of the students to return their quadrat pieces to the teacher to form each of the three research plots again.
11. Have student teams make a graph of the seagrass coverage in their quadrat over time, and of the overall seagrass coverage over time.
12. Ask the class to look closely at both the plots and the summary information on the chalkboard. Then ask the students to use the

data from the entire research plot to determine the state of the community and make recommendations for the management of the community. They should record their thoughts on their data sheets

FOLLOW-UP:

Have a class discussion covering the following questions:

1. What was it like working with other “scientists” to complete this work? Were there differences in data collection methods? What could be done to avoid any inconsistencies during research of this type?
2. What changes did you notice in each species of seagrass over time?
3. Why do you think these changes occurred? What evidence or data led you to believe this?
4. Were there changes in plant species? Animal species? Why do you think this may have occurred?
5. How does this type of data collection help scientists?
6. What do you think could be done to help preserve the seagrass system?

ASSESSMENT:

Team Assessment:

1. Students will answer questions on their data sheets and turn the work in for review.

Individual Assessment:

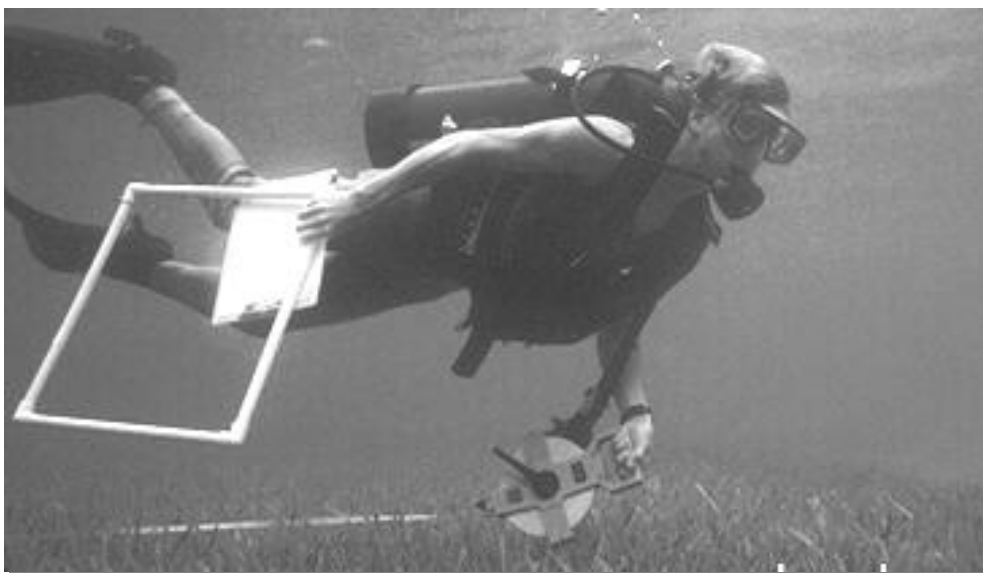
1. Give the students another set of simulated quadrats with descriptive data. Have each student individually calculate percent cover and answer questions about the data.

POST ACTIVITIES:

Using the Internet, have students complete a search on different survey/inventory methods (i.e. transect, quadrat, point count). Have them find examples of these methods that they can share with others. As a class list the different types of research methods that the students found so that they can see all the different types of projects that use this technique. If possible try to examine some of the projects to determine what the scientist was trying to prove or disprove.

RESOURCES:

- Florida Fish and Wildlife Conservation Commission Marine Grasses Overview: <http://floridaconservation.org/psm/habitat/seagrassesover.htm>
- Office of Naval Research, Marine Technology Focus: <http://www.onr.navy.mil/focus/ocean/motion/default.htm>
- The Quadrat Method; Arizona Schools: http://www.tuhsd.k12.az.us/Corona_del_Sol_HS/Departments/Science/quadrat.html
- Florida Fish and Wildlife Conservation Commission, The Florida Marine Research Institute, Sea Grass Photo Gallery: http://www.floridamarine.org/gallery/view_category.asp?catid=1323&subcatid=2649
- *Seagrass* video by Sea Grant. 2003. Contact Andrew Diller at 850-475-5230 to order. <http://www.resourcerangers.org/>



Researcher using the quadrat method to map seagrasses.

VOCABULARY

Grazers: Herbivores, animals that feed on plants. Examples include, manatees and sea turtles, which eat seagrasses.

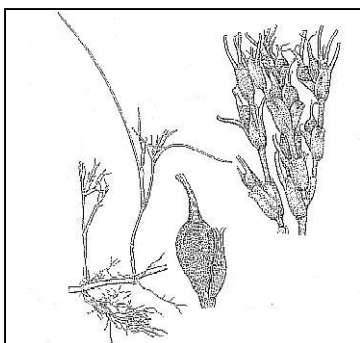
Monitoring: To study an area in order to view any changes over time.

Percent cover: The percentage of an area that something covers.

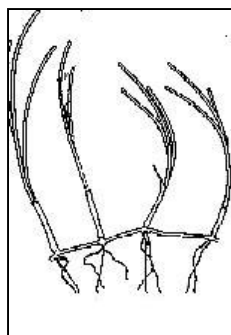
Research Plot: The total number of quadrats surveyed in a specified area.

Quadrat sampling: A quadrat is a square, rectangle, circle or other shape that is used as a sample unit. In sampling using quadrats, small, manageable areas of known dimensions are designated as the sample unit. A number of quadrats are selected to provide the data needed to estimate the population parameters of interest. Quadrats are often called plots.

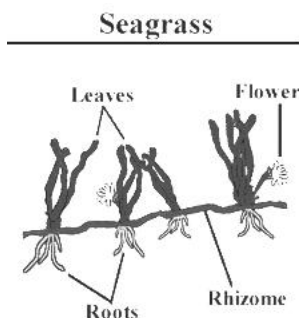
Seagrass (es): Are true flowering plants with roots, stems, leaves and flowers. Seagrasses grow and pollinate underwater. They have strong roots that anchor them into the sediment. They usually grow in shallow protected areas where they can receive sunlight. If water is clear, some species like shoal grass can grow in water depths of 100 feet. Many animals need seagrass beds for food or shelter.



Manatee Grass



Shoal Grass



SUNSHINE STATE STANDARDS ACTIVITY CORRELATIONS

Science

Processes that Shape the Earth

Standard 1: The student recognizes that processes in the lithosphere, atmosphere, hydrosphere, and biosphere interact to shape the Earth. (SC.D.1.2)

SC.D.1.2.3: knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

SC.D.1.2.4: knows that the surface of the Earth is in a continuous state of change as waves, weather, and shifts of the land constantly change and produce many new features.

SC.D.1.2.5: knows that some changes in the Earth's surface are due to slow processes and some changes are due to rapid processes.

Processes of Life

Standard 1: The student describes patterns of structure and function in living things. (SC.F.1.2)

SC.F.1.2.2: knows how all animals depend on plants.

SC.F.1.2.3: knows that living things are different but share similar structures

Standard 2: The student understands the process and importance of genetic diversity. (SC.F.2.2)

SC.F.2.2.1: knows that many characteristics of an organism are inherited from the parents of the organism, but that other characteristics are learned from an individual's interactions with the environment.

How Living Things Interact with Their Environment

Standard 1: The student understands the competitive, interdependent, cyclic nature of living things in the environment. (SC.G.1.2)

SC.G.1.2.1: knows ways that plants, animals, and protests interact.

SC.G.1.2.2: knows that living things compete in a climatic region with other living things and that structural adaptations make them fit for an environment.

SC.G.1.2.3: knows that green plants use carbon dioxide, water, and sunlight energy to turn minerals and nutrients into food for growth, maintenance, and reproduction.

SC.G.1.2.4: knows that some organisms decompose dead plants and animals into simple minerals and nutrients for use by living things and thereby recycle matter.



SC.G.1.2.5: knows that animals eat plants or other animals to acquire the energy they need for survival.

SC.G.1.2.6: knows that organisms are growing, dying, and decaying and that new organisms are being produced from the materials of dead organisms.

SC.G.1.2.7: knows that variations in light, water temperature, and soil content are largely responsible for the existence of different kinds of organisms and population densities in an ecosystem.

Standard 2: The student understands the consequences of using limited natural resources. (SC.G.2.2)

SC.G.2.2.1: knows that all living things must compete for Earth's limited resources; organisms best adapted to compete for the available resources will be successful and pass their adaptations (traits) to their offspring.

SC.G.2.2.2: knows that the size of a population is dependent upon the available resources within its community.

SC.G.2.2.3: understands that changes in the habitat of an organism may be beneficial or harmful.

The Nature of Science

Standard 1: The student uses the scientific processes and habits of mind to solve problems (SC.H.1.2)

SC.H.1.2.1: knows that it is important to keep accurate records and descriptions to provide information and clues on causes of discrepancies in repeated experiments.

SC.H.1.2.2: knows that a successful method to explore the natural world is to observe and record, and then analyze and communicate the results.

SC.H.1.2.3: knows that to work collaboratively, all team members should be free to reach, explain, and justify their own individual conclusions.

SC.H.1.2.4: knows that to compare and contrast observations and results is an essential skill in science.

SC.H.1.2.5: knows that a model of something is different from the real thing, but can be used to learn something about the real thing.

Standard 2: The student understands that most natural events occur in comprehensible, consistent patterns. (SC.H.2.2)

SC.H.2.2.1: knows that natural events are often predictable and logical.

Standard 3: The student understands that science, technology, and society are interwoven and interdependent. (SC.H.3.2)



- SC.H.3.2.1: understands that people, alone or in groups, invent new tools to solve problems and do work that affects aspects of life outside of science.
- SC.H.3.2.2: know that data are collected and interpreted in order to explain an event or concept.
- SC.H.3.2.3: knows that before a group of people build something or try something new, they should determine how it will affect other people.
- SC.H.3.2.4: knows that through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas.

Math

Data Analysis and Probability

Standard 1: The student understands and uses the tools of data analysis for managing information. (MA.E.1.2)

MA.E.1.2.3: analyzes real-world data to recognize patterns and relationships of the measures of central tendency using tables, Charts, histograms, bar graphs, line graphs, pictographs, and circle graphs generated by appropriate technology, including calculators and computers.

Standard 3: The student uses statistical methods to make inferences and valid arguments about real-world situations. (MA.E.3.2)

MA.E.3.2.1: designs experiments to answer class or personal questions, collects information, and interprets the results using statistics (Range, mean, median, and mode) and pictographs, and line graphs.

Language Arts

Reading

Standard 2: The student constructs meaning from a wide range of texts. (LA.A.2.2)

- LA.A.2.2.1 reads text and determines the main idea or essential message, identifies relevant supporting details and facts, and arranges event in chronological order.
- LA.A.2.2.5: reads and organizes information for a variety of purposes, including making a report, conducting interviews, taking a test, and performing an authentic task
- LA.A.2.2.8: selects and uses a variety of appropriate reference materials, including multiple representations of information, such as maps, charts and photos, to gather information for research projects.

Writing

Standard 1: The student uses writing processes effectively. (LA.B.1.2.)

LA.B.1.2.1: prepares for writing by recording thoughts, focusing on central idea, grouping related ideas, and identifying the purpose for writing.



- LA.B.1.2.2: Drafts and revises writing in cursive that: focuses on the topic; has logical organizational pattern, including a beginning, middle, conclusion, and transitional devices; has ample development of supporting ideas; demonstrates a sense of supporting ideas; demonstrates a sense of completeness or wholeness; demonstrates a command of language including precision in word choice; generally has correct subject/verb agreement; generally has correct verb and noun forms; with few exception, has sentences that are complete, expect when fragments are used purposefully; uses a variety of sentence structures; and generally follows the conventions of punctuation, capitalization, and spelling.
- LA.B.1.2.3: produces final documents that have been edited for: correct spelling; correct use of punctuation, including commas in series, dates, and addresses, correct capitalization of proper nouns; correct paragraph indentation; correct usage of subject/verb agreement, verb and noun forms, and sentence structure; and correct formatting according to instructions.

Standard 2” The student writes to communicate ideas and information effectively. (LA.B.2.2)

- LA.B.2.2.1: writes notes, comments, and observations that reflect comprehension of content and experiences from a variety of media.

Standard 3: The student uses speaking strategies effectively. (LA.C.3.2)

- LA.C.3.2.1: speaks clearly at an understandable rate and uses appropriate volume.
- LA.C.3.2.2: asks questions and makes comments and observations to clarify understanding of content processes, and experiences.
- LA.C.3.2.3: speaks for specific occasions, audiences, and purposes including conversations, discussions, projects, and informational or imaginative presentations.
- LA.C.3.2.4: uses eye contact and gestures that engage the audience.
- LA.C.3.2.5: participates as a contributor and occasionally acts as a leader in a group discussion.
- LA.C.3.2.6: organizes a speech using a basic beginning, middle, and ending.



Sea Grass Data Sheet 1

Name:

Seagrass Scientists

Healthy Seagrass Community Description:

Potential impacts to the seagrass community:



Sea Grass Data Sheet 2

Name:

Seagrass Scientists

Each team member should fill out this data sheet using information you collect from your 1980, 1990, and 2000 quadrats.

Draw what you see in each of your research quadrats. Include both plants and animals.

1980

1990

2000

After your teacher has shown you how to complete the next section, work as a team to collect the information. Each student should record the answers on their own data sheet.

Record estimated coverage area for seagrass species as a fraction.

	1980	1990	2000
Shoal Grass			
Manatee Grass			
Barren Areas			
Total (Should =1)			

Calculate percent cover of the seagrass species in your research quadrat.

	1980	1990	2000
Shoal Grass			
Manatee Grass			
Barren Areas			
Total (Should = 100%)			

Record any animal species found.

1980	
1990	
2000	

Seagrass Scientists

Record the data collected by your classmates from the 1980 research plot here. Write the information as a percent cover of each species.

1980 Map

Plant and Animal Species Present:

Percent cover of shoal grass for entire research plot:

Percent cover of manatee grass for entire research plot:

Percent cover for Barren area for entire research plot:



Seagrass Scientists

Record the data collected by your classmates from the 1980 research plot here. Write the information as a percent cover of each species.

1990 Map

Plant and Animal Species Present:

Percent cover of shoal grass for entire research plot:

Percent cover of manatee grass for entire research plot:

Percent cover for Barren area for entire research plot:

Seagrass Scientists

Record the data collected by your classmates from the 1980 research plot here. Write the information as a percent cover of each species.

2000 Map

Plant and Animal Species Present:

Percent cover of shoal grass for entire research plot:

Percent cover of manatee grass for entire research plot:

Percent cover for Barren area for entire research plot:

